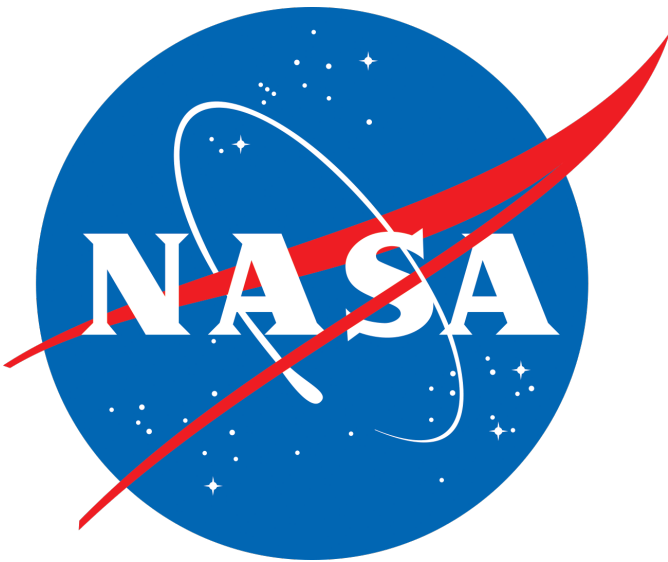
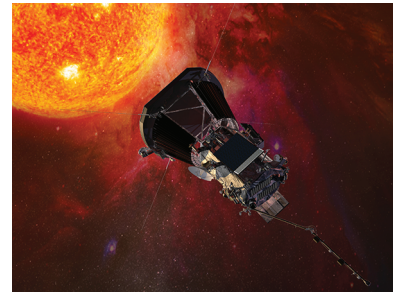
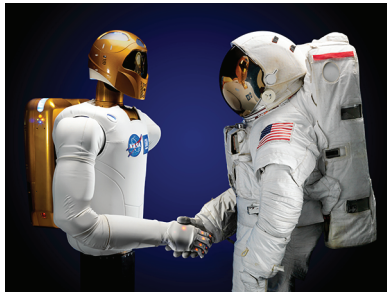
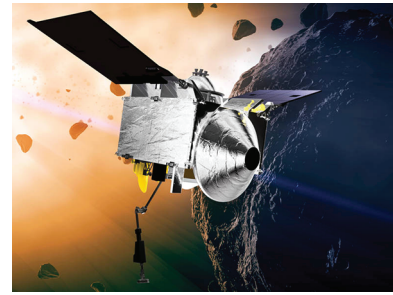
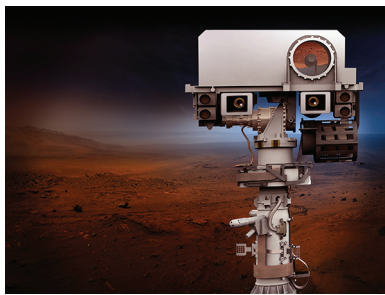


NASA's Independent Verification and Validation Program SOFTWARE DEVELOPMENT, TESTING, & RESEARCH

<https://www.nasa.gov/centers/ivv>



**Ensuring Safe, Reliable,
Secure Operation
of Safety & Mission
Critical Software**

Enabled through IV&V's Jon McBride Software Testing and Research (JSTAR) Laboratory, IV&V provides independent testing, simulation and software automation.

NASA's IV&V Program

SOFTWARE DEVELOPMENT, TESTING & RESEARCH

<https://www.nasa.gov/centers/ivv/jstar/JSTAR.html>



Within NASA's IV&V Program, the Jon McBride Testing and Research (JSTAR) laboratory provides simulations of embedded spacecraft environments and test services to verify and validate spacecraft flight software products from NASA flight projects. Research and development is conducted to improve test methods and simulations of embedded system components and space environments.

JSTAR Capabilities

Independent Testing

Independent testing provides the IV&V Program with the ability to dynamically verify and validate safety and mission critical software. The goal of independent testing is to ensure that must-work software works as intended and handles adverse conditions. The independent testing is focused and risk-driven. Independent testing provides tangible evidence, such as test scripts and test results as to exactly how the software operates in its environment. Independent testing is typically performed by IV&V teams on software-only test environments to provide IV&V with the flexibility to setup tests that stress the software during testing. Examples of IV&V tests include, but are not limited to: fault injection, long-duration tests and error handling.

Simulation

Within the IV&V Program, the JSTAR team creates software-only environments using hardware emulation, simulation integration, as well as custom in-house simulation software.

- Hardware Emulation

This technique provides a means to model physical hardware components, such as flight computers and complex electronic devices (field-programmable gate array, application-specific integrated circuit, etc.) such that the actual flight software can be exercised on an emulated platform. Basically, it enables flight software to be executed on a standard, personal computer versus its intended hardware environment.

- Simulation Integration

JSTAR integrates both internally-developed simulation components together, but also integrates simulation components developed by external development organizations (e.g. dynamic simulators, payload simulators, etc.) to create an all-digital spacecraft environment (a single, integrated product).

- In-House Simulation Software

Over time, JSTAR has developed a suite of simulation software utilities and tools to make the process of developing simulations of NASA mission systems easier. A few examples of these tools are:

- NASA Operational Simulation (NOS) Engine, passing simulation software to interface two or more simulated components. NOS Engine supports common communications, such as SpaceWire, 1553, 12C and SPI.
- NOS³ a software framework that enables software development and V&V of small satellite missions.

The final product of all of this is a JSTAR-developed, software-only simulator, equipping NASA's IV&V Program with the ability to independently test, verify and validate mission elements as well as entire missions without the use of hardware - saving time, money, resources and increasing safety for NASA.

Software Automation

Software Automation enables faster simulation environment deployments and a lightweight means to configuration-manage the test environments. Software automation is the automation of a task in order to test the outcome and behaviors of certain systems and modules. JSTAR utilizes this service to support unit-level testing of in-house developed software, generate virtual machine deployments of in-house developed simulation and test environments, and support testing of customer software. Software Automation is an extremely useful service, and has been provided by JSTAR for many missions and projects to date.